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EARLY EOCENE RODENTS (MAMMALIA) FROM SHANDONG PROVINCE, PEOPLE'S REPUBLIC OF CHINA

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ABSTRACT

Early Eocene deposits in the County Mine locality of the Wutu Basin, Shandong Province, People's Republic of China, have yielded a varied mammalian fauna that includes three families of rodents. The family Alagomyidae, previously named for taxa from Mongolia, is represented by a new species. The Ctenodactyloidea, becoming well known in eastern Asia, are represented by a new genus and species. The first occurrence of the family Paramyidae in the Early Eocene of Asia is recorded by a new genus and two new species.

INTRODUCTION

The fossil record of eastern and central Asia is now considered to hold the key to the origin and early evolution of the order Rodentia, based both on presence of relatively primitive rodents in the record and on the affinities of rodents with middle and late Paleocene Asian eurymyloids or mixodonts (Li, 1977; Dashzeveg and Russell, 1988). Excluding the rodent-like (or rodent) Asian middle and late Paleocene *Heomys,* the Asian fossil record for the order Rodentia dates from the Early Eocene. Two distinctly different Asian endemic families, Cocomyidae and Alagomyidae, have been recognized previously as coming from deposits of earliest Eocene, or Bumbanian, age (Dawson et al., 1984; Dashzeveg, 1990*b*). Recently discovered fossils from the Wutu Basin of Shandong Province in eastern People's Republic of China document the presence of the Alagomyidae, and add a rodent questionably referred to the ctenodactyloid family Yuomyidae and the first record of the Holarctic family Paramyidae in the Early Eocene of Asia.

THE WUTU LOCALITY

The first mention of early Cenozoic fossil-bearing deposits in the Wutu Basin of the Changle District, Shandong Province (Fig. 1), was by Chow and Li (1963) of the Institute of Vertebrate Paleontology and Paleoanthropology (IVPP), who reported the presence of the isectolophid genus *Homogalax* and mentioned its close similarity to the Early Eocene North American *Homogalax protapirinus.* Later they named the new species *Homogalax wutuensis* for this perissodactyl, which came from the middle of the Wutu Formation (Chow and Li, 1965). Indeterminate remains of members of the order Pantodonta were also reported. In 1981 work was begun by Y. Li of the Chinese Geological Ministry, who collected the pantodont *Heterocoryphodon.* In 1990 Y. Tong and J. Wang of the IVPP initiated new investigations, concentrating their collecting in the County Mine

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Fig. 1.—Map of People's Republic of China (left) with Shandong Province (stipple), and enlargement of Shandong (right) showing location of the Wutu Basin.

locality. Recently, the new soricomorph family Changlelestidae was named from this Early Eocene locality (Tong and Wang, 1993) and two new genera of the mammalian family Carpolestidae were added to the fauna (Beard and Wang, 1995). This locality also produced the rodents reported here.

The coals of the County Mine locality contain rodent and carpolestid assemblages that include the geologically oldest records of both paramyids and carpolestids in Asia. An interesting taphonomic parallel to the County Mine locality occurs in the earliest Clarkforkian Eagle Coal Mine, Bear Creek, Montana (Simpson, 1929; Jepsen, 1937). In this Montana site, fossils from a carbonaceous clay above a coal seam include North America's oldest rodent, *Acritoparamys atavus,* as well as relatively abundant carpolestids. The parallel occurrences suggest that these mammals had a preference for swampy habitats, which are relatively rarely sampled in the fossil record.

Abbreviations

Collections mentioned in the text include those of the Institute of Vertebrate Paleontology and Paleoanthropology, Academia Sinica, Beijing (IVPP); the Department of Paleontology and Stratigraphy, Institute of Geology, Academy of Sciences of the Mongolian People's Republic, Ulan Bator (PSS); and the Paleontological Institute of the Russian Academy of Sciences (PIN). Measurements are in millimeters (mm).

Systematic Paleontology

Order Rodentia Bowdich, 1821
Family Alagomyidae Dashzeveg, 1990
Alagomys Dashzeveg, 1990

The unusual Paleogene rodent *Alagomys* was described by Dashzeveg (1990*b*) from Tsagan Khushu, Quarry 1, low in the Lower Eocene Bumban Member of the Naran-bulak Formation located in the central part of the Nemegt Basin,

Table 1.—*Measurements (in mm) of rodents from the Wutu Basin.*

	Alagomys oriensis IVPP 10693	*Bandaomys zhonghuaensis* IVPP 10689		*Taishanomys changlensis* IVPP 10691	*Acritoparamys? wutui* IVPP 10692
P^4 length	—	1.14		—	—
width	—	1.51		—	—
M^1 length	—	1.44		—	—
width	—	1.68		—	—
M^2 length	—	1.60		—	—
width	—	1.60		—	—
M^3 length	0.77	—		—	—
width	0.84	—		—	—
		Left	Right		
P_4 length	0.77	1.24	—	—	—
width trigonid	0.54	0.94	—	—	—
width talonid	0.71	1.01	—	—	—
M_1 length	0.71	1.60	1.60	2.71	2.58
width trigonid	0.60	1.24	1.14	1.97	1.97
width talonid	0.81	1.31	1.27	2.37	2.24
M_2 length	0.81	—	1.68	2.92	2.58
width trigonid	0.71	—	1.34	2.51	2.24
width talonid	0.84	—	1.41	2.85	2.51
M_3 length	0.97	1.71	1.60	3.39	—
width trigonid	0.74	1.40	1.40	2.44	—
width talonid	0.81	1.27	1.18	2.71	—

Mongolian People's Republic. *Alagomys* was named on the basis of PSS No. 20-176, described as a maxilla with P^4–M^2, and PSS No. 20-177, a mandibular fragment with M_1–M_2. Its ordinal affinities are shown by such rodent characteristics as the enlarged, ever-growing incisor separated by a diastema from the cheek teeth, and the structure of the lower molars, which lack a paraconid and are quadrate to rhomboidal in shape with prominent metaconid, well-developed ectolophid, and hypoconulid on the posterolophid. *Alagomys* is a tiny rodent. Its specific name, *A. inopinatus,* was coined in reference to the "unexpected" upper molars, which are unusual for a rodent in their triangular shape and complete lack of a hypocone. The P^4 of *A. inopinatus* was described as having two transversely oriented cusps and roots, as in early ctenodactyloid rodents. The upper molars are primitive also in having well-developed conules.

Another new rodent named by Dashzeveg (1990*b*) from the same locality, Quarry 1 of Tsagan Khushu, is *Orogomys obscurus,* the type of which, PSS No. 20-174, is an upper molar that has many features in common with that of *Cocomys lingchaensis* and other early Eocene ctenodactyloids. A lower jaw referred to *Orogomys* by Dashzeveg, PSS No. 20-175, appears to be *Alagomys,* although Dashzeveg discussed a few differences that it has from the type material of *Alagomys.* Our comparisons of the material from China described here are with published figures of the Mongolian type material of *Alagomys,* rather than to original material or casts. Nonetheless, the lower jaw referred to *Orogomys* appears from the figure and measurements to be a specimen of *Alagomys inopinatus.*

A new species of *Alagomys* from the Wutu Formation in Shandong Province of eastern China is here added to the family Alagomyidae. It expands the diversity and geographic range of the family, and contributes new evidence on the morphology of early Rodentia.

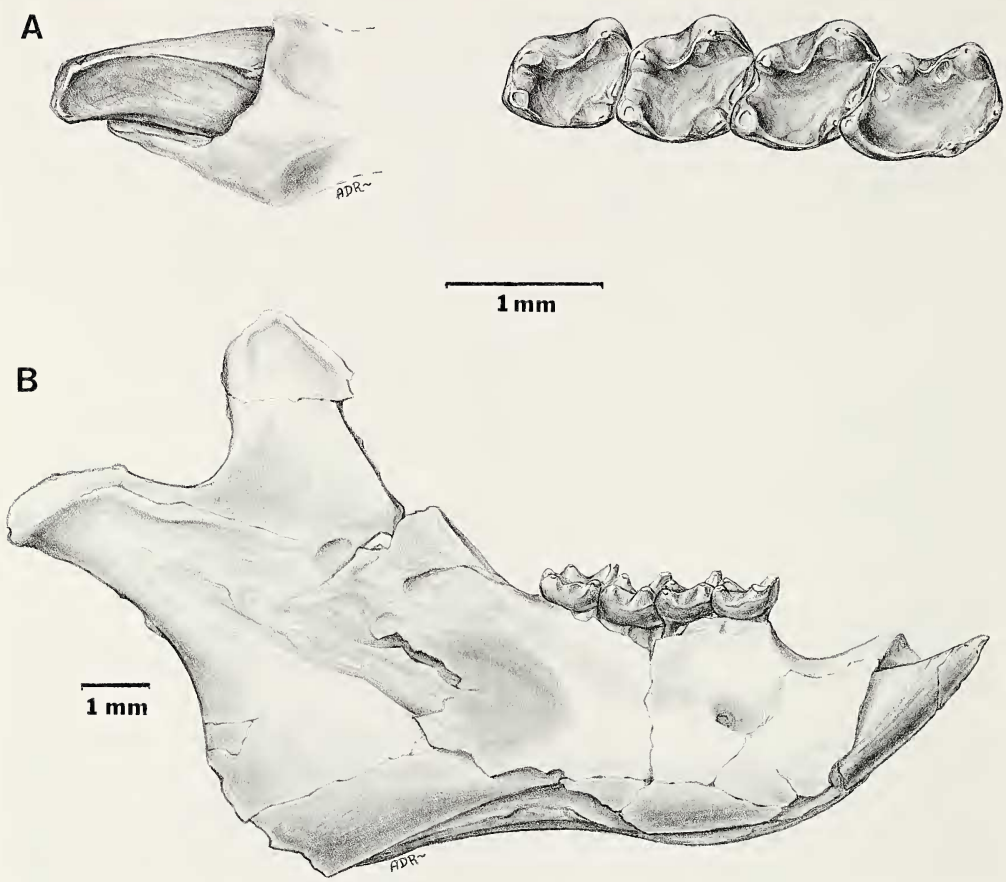

Fig. 2.—*Alagomys oriensis,* new species, IVPP 10693, holotype. A. Occlusal view of lower incisor and right P_4–M_3. B. Lateral view of right mandible.

Alagomys oriensis, **new species**

Holotype.—IVPP 10693, right mandible with I, P_4–M_3, left mandible with I, M_3, and separate left M^{1-3}, all associated in a piece of coal.

Referred Specimen.—IVPP 10694, left mandible with I, M_{1-2}, right lower incisor.

Horizon and Locality.—Wutu Formation, Lower Eocene, County Mine, Wutu Basin, Changle District, Shandong Province, People's Republic of China.

Diagnosis.—Differs from *Alagomys inopinatus* in having lower molars with protoconid relatively more anterior in position, so that the trigonid is short anteroposteriorly; more distinct buccal cingulum on M^{1-2}.

Etymology.—*oriens,* Latin—east; *-ensis,* Latin suffix denoting locality.

Description.—The holotype materials were associated in a small block of coal, and so are considered to represent one individual. The right mandible, nearly complete from incisor to condyloid process (Fig. 2), is the most complete currently known for the genus. It is sciurognathous, with the incisor and angle in the same plane. The diastema is short and dorsally concave. The masseteric fossa is distinctly indented but extends forward only to below the posterior edge of M_2 or anterior edge of M_3. The well-developed coronoid process rises well above the posteriorly sloping condyloid process, and has a slightly thickened dorsal tip.

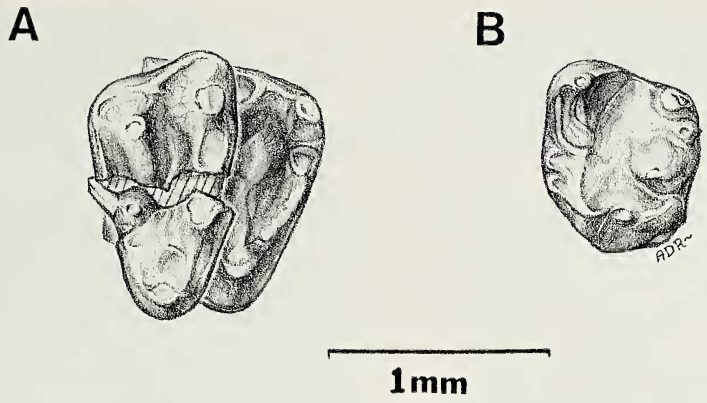

Fig. 3.—*Alagomys oriensis,* new species, IVPP 10693, occlusal views of holotype. A. Left M^1 overlying M^2. B. Left M^3.

The lower dentition of this tiny rodent is completely represented. The incisor is narrow transversely. Basically, each of the brachydont lower cheek teeth is rhomboidal in outline, with a high metaconid and small cuspate protoconid that is crowded to the anterior edge of the tooth. The lingual part of the anterior edge is formed by a loph from the metaconid. As a result of the configuration of protoconid and metaconid, the trigonid is very short anteroposteriorly. The ectolophid is distinctive, extending as a narrow ridge from the posterior side of the protoconid, curving buccally and posteriorly to intersect the hypoconid. The posterior cingulum-hypoconulid-entoconid are narrow anteroposteriorly, crowded behind a widely open basin, which extends obliquely from the middle of the lingual side to a groove between hypoconid and posterior cingulum. Occlusion in this animal clearly had a strongly oblique component. The molariform P_4 differs from M_{1-2}, mainly in its dimensions and its relatively longer trigonid. M_3 has a posteriorly expanded talonid with a prominent hypoconulid.

Of the upper dentition, only the molars are known (Fig. 3). M^1, which is broken in the only specimen, is preserved overlying M^2. These teeth resemble those of *A. inopinatus* in being narrow anteroposteriorly, elongate transversely, and in lacking a hypocone. Differences from *A. inopinatus* include a more nearly continuous buccal cingulum (ectoloph of Dashzeveg) and absence of a mesostyle. M^3, not represented in the Mongolian material, differs from the anterior molars in having a quadrate shape, centrally situated protocone on the lingual side, and relatively prominent metaconule. The dimensions of M^3 relative to those of the anterior molars indicate that the tooth row tapered in width posteriorly.

Discussion.—Incomplete material of both the genotype, *Alagomys inopinatus,* and the Chinese species, *A. oriensis,* makes comparisons and interpretations of phylogenetic position tenuous. Thus, the full extent of the differences between these species cannot be assessed. For example, P^4 has been described for the former species but is unknown in the latter; P_4 is unknown in the former, known in the latter. *Alagomys inopinatus* was described as having a nonmolariform P^4, with two transverse cusps and roots. In *A. oriensis,* P_4 is molariform, which would not be expected were its P^4 to resemble that of *A. inopinatus.* Such problems remain to be resolved once more complete material becomes available.

Alagomys and the approximately contemporary ?alagomyid *Tribosphenomys* (Meng et al., 1994) have opened questions regarding the primitive characters for rodents and their relationships to the many Asian Paleocene "mixodonts" now known (Dasheveg and Russell, 1988). The upper cheek teeth, lacking a hypocone or hypocone shelf, combined with the anteroposterior compression of the trigonids differentiate the alagomyids not only from early paramyid rodents but also from mixodonts.

There is no trace of a paraconid in the cheek teeth of *Alagomys,* and the trigonid

is compressed anteroposteriorly. This compression plus absence of the hypocone on the upper cheek teeth produces an appearance that is somewhat like that of modern ground squirrels. In the latter, however, there is a very well-developed anterior cingular shelf on the upper cheek teeth. Occlusion appears to have had a strongly oblique component, shown most clearly in morphology of the talonid basin.

Another rodent in the size range of *Alagomys* from the Bumban Member at Tsagan Khushu was described by Shevyreva (1989) as *Ivanantonia efremovi* and assigned to a new family Ivanantoniidae. Although known only by lower jaw fragments, *Ivanantonia* was described as having an hystricomorphous skull, a leap of faith that is difficult to accept. According to the diagnosis for this taxon, P_4 is absent, which would differentiate it from all other Early Eocene rodents. However, another problem arises in that the holotype specimen, PIN 4040-27, is described as being a fragmentary left lower jaw with alveoli for P_4–M_2. This internal inconsistency in the original description leaves the status of *Ivanantonia* dubious at best. As described and figured, *Ivanantonia* differs from *Alagomys* in having a wide lower incisor and, on the lower molars, intersecting crests from protoconid and metaconid and a completely closed talonid basin.

Superfamily Ctenodactyloidea Simpson, 1945

At present, study of Eocene ctenodactyloids is best described as in a state of flux. Ten genera distributed among five families have been described from the Bumban Member at the Tsagan Khushu locality in Mongolia alone (Shevyreva, 1989; Dashzeveg, 1990*a*). Unfortunately, some of them are inadequately known, making comparisons difficult and affinities obscure. These rodents are currently being revised (J.-L. Hartenberger, personal communication, 1993). It may seem irresponsible to add to this diversity a new genus for the ctenodactyloid from Wutu, but this course is taken here because of apparent distinctions of the Wutu species from the plethora of other Early Eocene ctenodactyloid taxa, based on published descriptions and figures.

?Family Yuomyidae Dawson, Li, and Qi, 1984

The ctenodactyloid families Yuomyidae and Cocomyidae differ most importantly in the structure of the fourth upper and lower premolars. In the Yuomyidae these teeth are submolariform, with metacone on P^4 and hypoconulid on P_4, whereas in the Cocomyidae they are nonmolariform and apparently more primitive (Dawson et al., 1984). The new ctenodactyloid rodent in the Wutu fauna shares many features with cocomyids, but is referred questionably to the Yuomyidae because it is closer to the yuomyids in premolar morphology.

Bandaomys zhonghuaensis, **new genus and species**

Holotype.—IVPP 10689, left maxilla with incisor, P^4–M^2, right M^1, M^3; left mandible with P_4–M_1, M_3, right mandible with M_1, isolated P_4, M_2, M_3.

Horizon and Locality.—Wutu Formation, Lower Eocene, County Mine, Wutu Basin, Changle District, Shandong Province, People's Republic of China.

Diagnosis.—Differs from other Early Eocene ctenodactyloids by the following combination of characters: rudimentary metacone and no protoconule on P^4; no "protoparastyle" (Shevyreva, 1989) on the upper molars; weakly developed hypoconulids on lower cheek teeth; P_4 talonid wider than trigonid, entoconid much larger than hypoconid; M_1 trigonid and talonid about equal in width; small me-

Fig. 4.—*Bandaomys zhonghuaensis,* new genus and species, IVPP 10689, holotype, oblique view of skull fragment with incisor, P^4–M^2. Stereo pair. Scale bar = 1 mm.

soconid, much smaller than other main cusps of lower cheek teeth; only slightly increase in size of lower cheek teeth toward posterior.

Etymology.—*bandao,* Chinese—peninsula, and *mys,* Greek—mouse; *zhonghua,* Chinese—China, and *-ensis,* Latin suffix denoting locality.

Description.—The left maxillary fragment is somewhat crushed and provides no clear evidence on the zygomasseteric structure (Fig. 4), an important character in determining familial affinities in the early ctenodactyloids. P^3, not preserved in IVPP 10689 (Fig. 5A), has a single alveolus. P^4 has two major cusps oriented transversely. A small cuspule on the posterior side of the paracone is probably a rudimentary metacone. The metaconule is strong. Both anterior and posterior cingula are prominent. The number of roots is not entirely clear but it appears that only one buccal root was present. M^1 has a strong anterior cingulum and well-developed conules. The mesostyle blocks the central valley. On M^2 the anterior cingulum has a relatively smaller anterobuccal shelf and the conules are somewhat smaller.

On P_4 (Fig. 5B) the trigonid has distinct protoconid and metaconid, of which the latter is larger. The talonid is slightly wider than the trigonid, and the hypoconid is smaller and less cuspate than the entoconid. A tiny cuspule, reminiscent of a rudimentary paraconid, is on the anterior wall, in front of the metaconid. On M_{1-2} the swollen buccal ridge of the metaconid extends into the valley between the protoconid and the anterior cingulum. The ectolophid is weak with a swollen mesoconid. The hypoconulid is slightly enlarged. M_3 is similar to M_2 but differs in having the hypoconulid expanded somewhat more posteriorly, although it is not as pronounced as in many ctenodactyloids.

Discussion.—The fossil record now shows that by the Early Eocene some diversity was present within the ctenodactyloid rodents. In this group, *Bandaomys* has several features that differentiate it from *Cocomys,* including presence of a tiny metacone on P^4, the wider talonid on P_4, the lack of pronounced increase in

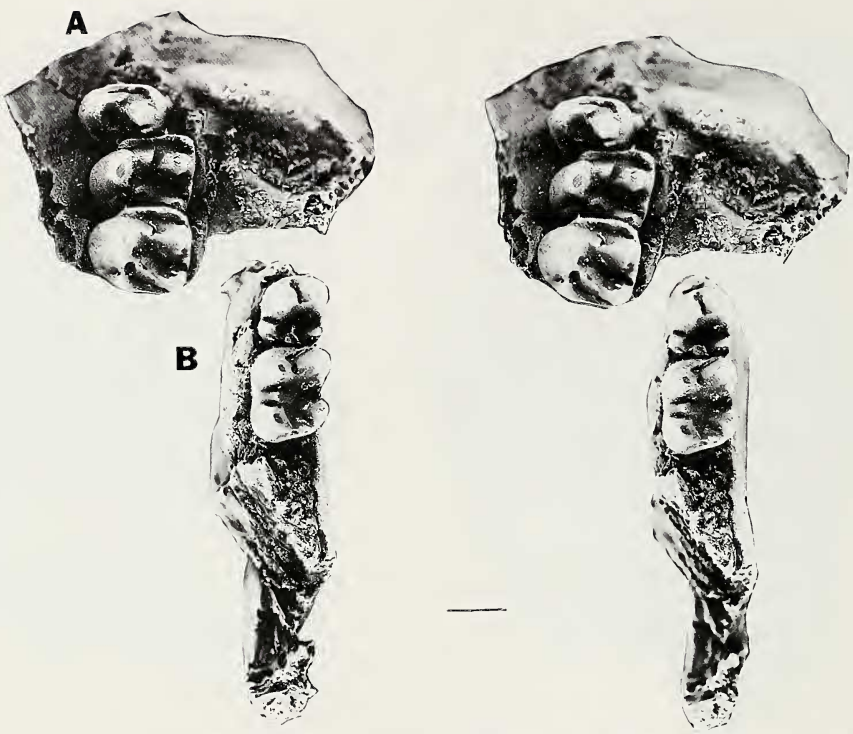

Fig. 5.—*Bandaomys zhonghuaensis,* new genus and species, IVPP 10689, holotype, occlusal views. A. Left maxilla with P^4–M^2. B. Left mandible with P_4–M_1. Stereo pairs. Scale bar = 1 mm.

size posteriorly of the lower cheek teeth, and the relatively poorly developed hypoconulid. These characters suggest that *Bandaomys* may be near the base of the ctenodactyloid family Yuomyidae, which has a metacone on P^4 and a well-developed hypoconid on P_4. A slightly younger yuomyid, *Advenimus hubeiensis,* has been reported from the late early or early middle Eocene of Hubei Province (Dawson et al., 1984).

Known Eocene ctenodactyloids are limited to Asia, where their diversity and abundance mirrors that of the paramyids in the Eocene of North America.

Family Paramyidae Miller and Gidley, 1918

The record of paramyid rodents in China and Mongolia contrasts strongly with that of North America. In the Clarkforkian through Wasatchian of western North America, 12 genera have been reported (Korth, 1984; Ivy, 1990). In the approximately comparable late Paleocene through early Eocene of China and Mongolia, however, none were previously reported. Europe also accommodated only a few paramyids, three genera having been reported from the Early Eocene. The Middle Eocene Arshanto fauna, Irdin Manha Formation, of Inner Mongolia includes the paramyid *Asiomys* (Qi, 1987), and a few incompletely known paramyids have been reported from deposits of similar age in Kazakhstan (Shevyreva, 1984). Paramyids apparently never dominated rodent faunas of the Asian Eocene as they

did in North America. Two genera of primitive paramyid rodents occur in the Wutu fauna.

Taishanomys changlensis, **new genus and species**

Holotype.—IVPP 10691, left jaw with M_{1-3}. (County Mine, 1991.10.22).

Horizon and Locality.—Wutu Formation, Lower Eocene, County Mine, Wutu Basin, Changle District, Shandong Province, People's Republic of China.

Diagnosis.—Paramyid rodent having mandible with short diastema, masseteric fossa extending forward to below M_3. Lower molars brachydont, with transversely long anterior cingulum, cuspate metaconid most prominent cusp; trigonid basin bracketed posteriorly by protoconid arm. Trigonid of M_1 relatively long anteroposteriorly.

Etymology.—*Taishan,* one of the five holy mountains of the People's Republic of China, in western Shandong Province; *mys,* Greek—mouse; *changle,* the district in which the fossils were found; *-ensis,* Latin suffix denoting locality.

Description.—The only known specimen is a well-preserved jaw of a large rodent, with M_{1-3} preserved (Fig. 6). The jaw is deep and has a short diastema, with a marked dorsal crest below the diastema. Two mental foramina are situated below the alveolus for P_4, the ventral larger than the dorsal. The masseteric fossa extends forward only to a line below the trigonid of M_3, far back for a rodent. The jaw appears to have been sciurognathous.

The incisor is narrow transversely, and the enamel of its anterior face extends about one-third of the way up the lateral surface. P_4 is not preserved; its alveolus shows that the tooth was two-rooted. The molars are brachydont, with rounded cusps. The metaconid, the most prominent cusp, is cuspate, not lophate on its buccal side, and slopes into the trigonid basin. M_1 and M_2 are similar in having the trigonid narrower than the talonid, but otherwise differ in morphology. On M_1 the trigonid is relatively long anteroposteriorly. The anterior cingulum extends lingually in front of the metaconid but does not reach to the lingual wall. A stout posterior arm of the protoconid forms the posterior margin of a distinct trigonid basin. The weak ectolophid, well set-in lingually, has a mesostylid that is convex buccally. There is no hypolophid. The posterior cingulum is thick, forming the complete back wall of the tooth.

On M_2 the anterior cingulum is longer, extending nearly to the lingual wall. The posterior arm of the protoconid is straighter, defining a less rounded trigonid basin; the ectolophid is not complete, not connecting to the protoconid, and the mesoconid is more rounded. There is a distinct hypoconulid on the posterior cingulum.

On M_3 the anterior cingulum resembles that of M_1. The trigonid basin is not completely closed posteriorly by the posterior protoconid arm. The talonid is expanded posteriorly, bordered by the posterior cingulum with a swollen hypoconulid.

Discussion.—*Taishanomys* appears to be a primitive rodent on the basis of the following plesiomorphous characters: the posterior position of the masseteric fossa; the long anterior cingulum, which may be a remnant of a paraconid, free lingually from the metaconid; and the short diastema. Assignment to the family Paramyidae is based on the cuspate molars with the trigonid slightly compressed anteroposteriorly and a large talonid basin, with a poorly developed hypoconulid. Differences from the primitive family Alagomyidae include less compression of the molar trigonid, straighter ectolophid, and strong anterior cingulum. From the ctenodactyloids, *Taishanomys* differs in having essentially no development of lophids, hypoconulid small or absent, and trigonid narrower than talonid. The relationships of *Taishanomys* within the family Paramyidae cannot be clearly established on the basis of presently known characters, limited as they are to the mandible and lower molars. The paramyid rodent *Asiomys* from the middle Eocene Arshanto fauna is also incompletely known (Qi, 1987). It differs from *Taishanomys* in its larger size and having the anterior cingulum and posterior arm of the protoconid converging on the metaconid.

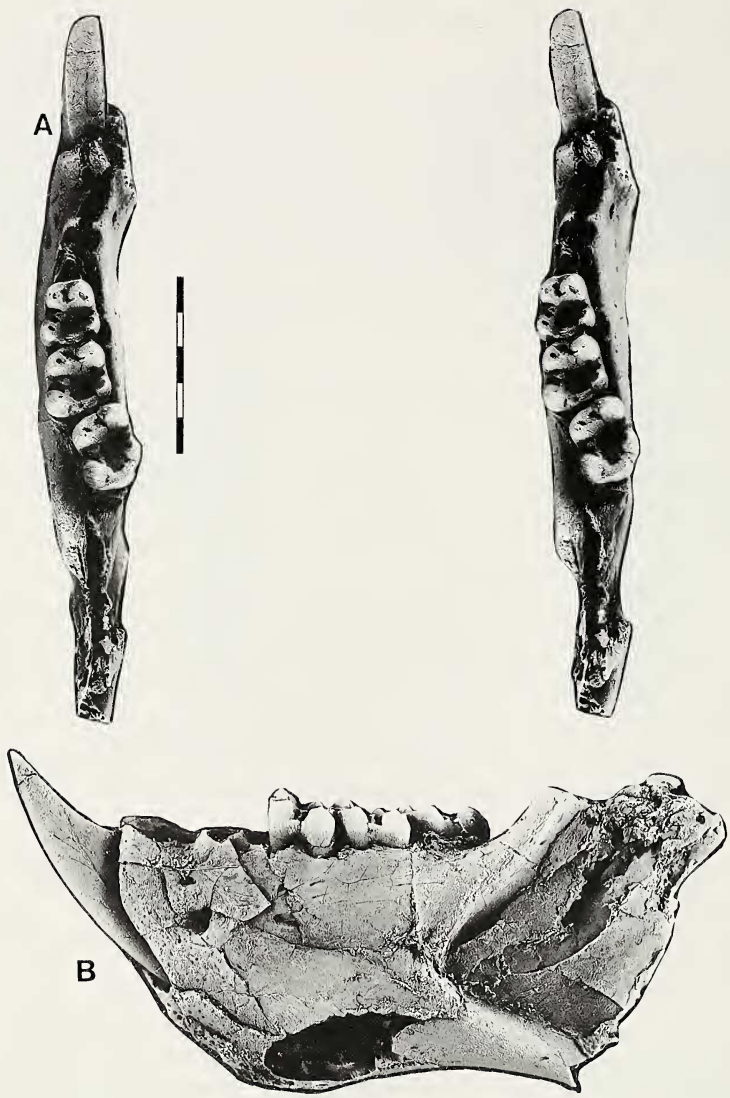

Fig. 6.—*Taishanomys changlensis,* new genus and species, IVPP 10691, holotype, left mandible. A. Occlusal view with M_1–M_3, stereo pair. B. Lateral view. Scale bar = 5 mm.

Acritoparamys? wutui, **new species**

Holotype.—IVPP 10692, right mandibular fragment with M_{1-2}.

Diagnosis.—Larger than *Acritoparamys atwateri.* Differs from other species of *Acritoparamys* in having lower molars with trigonids more compressed anteroposteriorly.

Description.—The very simple M_1 and M_2 (Fig. 7B) of this rodent resemble those of *Acritoparamys atwateri* in many features. On both teeth the metaconid is the most prominent cusp, and the entoconid is separated from the posterior cingulum by a slight groove, a character of *Acritoparamys.* The two known molars of *A.? wutui* differ from one another in the structure of the trigonid. On M_1 the small

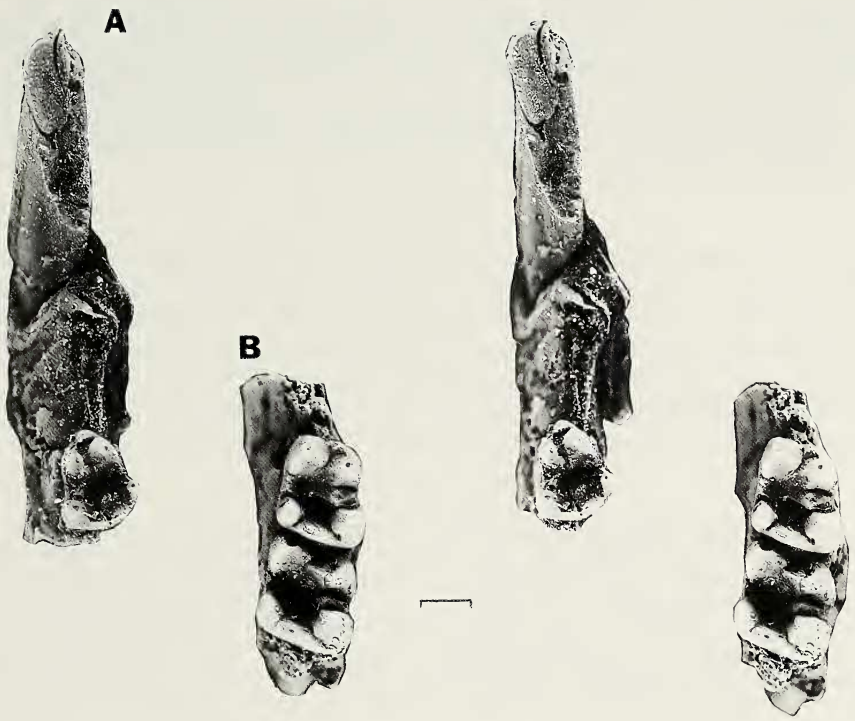

Fig. 7.—A. Rodent family indet., IVPP 10690, left jaw fragment with P_4 or dP_4. B. *Acritoparamys? wutui,* new species, IVPP 10692, holotype, right jaw fragment with M_{1-2}. Stereo pairs. Scale bar = 1 mm.

trigonid basin is closed posteriorly by a short posterior arm of the protoconid extending to a ridge from the posterobuccal flank of the metaconid. The anterior cingulum is short. On M_2, in contrast, the trigonid basin is more compressed anteroposteriorly, bounded posteriorly by the posterior arm of the protoconid that extends anterolingually to the posterior slope of the metaconid. The metaconid is situated at the anterolingual corner of the tooth, against the back of M_1. The hypoconulid is more distinct on M_2.

Discussion.—This rodent is so incompletely known that it offers little except an indication of some diversity among Asian Eocene paramyids. Like the larger *Taishanomys,* it is a relatively primitive paramyid. Its similarities to some species referred to the North American genus *Acritoparamys* are used as the basis for its questionable reference to that genus. The species currently included in *Acritoparamys* are in need of revision, especially because the genotype, *A. francesi,* differs considerably from the referred species. In addition, the questionable reference for this Asian paramyid should serve to avoid paleogeographic conclusions that are not warranted by the material.

Rodent, family indet.

Specimen.—IVPP 10690. Left mandibular fragment with incisor and P_4 or dP_4.

This fragment of rodent jaw cannot be assigned with certainty to family. The incisor is narrow transversely. The only cheek tooth, P_4 or dP_4 (length 1.71 mm, width of trigonid 0.90 mm, width of talonid 1.38 mm), has a wide talonid with a well-developed basin and an entoconid separated from the posterior cingulum

by a slight groove. The trigonid has three cusps (Fig. 7A), of which the metaconid is largest, and the anterior cusp ("paraconid"), smallest. This type of morphology, with a very small anterior cusp, has been described for dP_4 in other paramyids (Ivy, 1990:53). The only other character that might be used, size, does not match this rodent with any other described in the fauna. This fragmentary specimen may represent still another taxon.

Summary

The rodent assemblage from the County Mine locality of the Wutu Formation exhibits a diversity at the family level not known from other Asian Early Eocene sites. The range of morphological diversity between the Alagomyidae, ?family Yuomyidae, and Paramyidae is greater than exists within contemporary, or approximately contemporary, faunas in North America or Europe. This adds to the probability that rodents originated in and experienced their first radiations within Asia, and also that the order had its origins well into the Paleocene.

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